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UNGUENTS FOR RAILROAD MACHINERY.

The vast consumption of oil upon railroads has turned the attention of engineers to various compounds as substitutes, some of which have been recommended for their superior anti-attraction power, and nearly all, for their cheapness. The due consideration of this subject, is therefore, a matter of great importance whether we regard the saving of the machinery or the more direct economy of using a less costly substance than oil. To persons unacquainted with railroads, the latter may appear trifling, but it is well known to those accustomed to the details of expense of various roads, that the item of oil is no inconsiderable portion of the yearly cost of management. We remember a statement made upon good authority that \$1,000 was saved in six months upon one of the eastern railroads, by substituting tallow for oil.

Various experiments upon friction and unguents have led to certain results, which have been so fully confirmed that they may now be taken as data in any discussion of the subject. These results are as follows:

The friction without unguents is nearly invariable, for the same metals for any surface and velocity, being directly as the pressure.

The friction with unguents varies with the insistent weights, and with the nature of the unguents.

Each unguent therefore, appears to have a specific action independent of the nature of the rubbing surfaces.

The lighter the weights, the purer and more fluid should be the substance interposed, and vice versa.

Without entering into numerical detail, which we propose to give at another time, we shall merely give the general results, which have been obtained for particular substances. Oil, from its fluidity, has been found to answer admirably for light weights, and possessing the power of preventing oxidation, has added to its reputation as an unguent. But on increasing the weights, friction is found to increase rapidly, and with a weight of 10 cwt., and over, to be some times greater than with a weight of $\frac{1}{2}$ cwt. With hogslard, a smaller increase of friction is observed, but yet sufficient to discourage its use as an unguent.

With substances of great tenacity the results are far different—some of these compared with oil increase the friction with small weights and greatly diminished it with great weights. In all cases with such substances, the friction decreased with the pressure. A composition formed of black lead and hogslard, although producing varying results, was found to decrease the friction from $\frac{1}{4}$ to $\frac{1}{8}$ of the insistent weight. Tallow gave nearly the same results, with a more uniform action. Soft soap was found to be next in order, but the rate of decrease of friction, with the increase of weight, so rapid as to promise, at weights of half a ton or more to prove superior to tallow. A mixture of soft soap and black lead was next in order to soft soap alone. Black lead alone, at pressures of half a ton is about equal to oil.

Numerous receipts have been given for compounds of various natures to be used for railroad wheels, and most of them have been made with reference to the above named principles. The advantage of the harder compounds over oil, is that, while the latter feeds in the usual oil cups at all times, and therefore, consumes almost as rapidly in a stationary car as in one in use, the former are only reduced to the fluid state, by the heat of the wheels when in motion, and when quiescent, no loss is sustained during an indefinite period. The cost of these compounds being trifling, and the waste by spilling, etc., almost nothing, it is surprising that they have not entirely superceded oil, for the axles of wheels at least.

When black lead is used, great care must be taken to procure it in a state of purity and to reduce it to an impalpable powder, and this is easily accomplished by a process given below. Inattention to this precaution has sometimes caused mischief, and thrown discredit upon all mixtures containing black lead. For the same reasons it is desirable to keep all dust out of vessels containing the oil or other grease to be used.

It is quite likely that many new combinations may be made quite

as good as any in use, and as experiments have not been made to test the relative value, much yet remains to be known, but this much is certain that some pastey or semi-fluid oil, or soap, either alone or combined with black lead, should in all cases be preferred to oil. The solid palm oil appears to be one of the most suitable substances for these mixtures.

The following remarks from Lecount, are very good, and we give them without abridgement, as containing the best process for purifying plumbago for anti-friction compounds :

"Grease tubs will be required, with lids to them, and wooden knives to fill the boxes of the carriages with the grease. One man should be specially stationed to do this, and nobody else allowed to touch it: and he should be charged to keep the grease free from dust. The carriages suffer very much from this; the rapid motion and the friction consequent on dust getting into the grease, bringing on rapid wear both of the axles and the boxes.

"The grease which is put in at the grease box, over the axels of the carriage, after having performed its duty, gradually falls out at the lower part of the box; and through the action of the wind, often falls on the inner part of the tire of the wheel. This should be carefully cleared away occasionally, and the boxes filled every journey; although instances have been known, of well made boxes and axles not requiring a fresh supply of grease, till the carriage had travelled 800 miles.

"The best kind of grease for railway carriages, is an object of no small importance, from the great loss incurred in the wear and tear of carriage axles. The two following compositions have been very strongly recommended for railway works; but we have had no opportunity of speaking of them from our own personal knowledge. The one is composed of Dantzic soap, boiled for half an hour in as much palm oil as it will dissolve, and a small quantity of water; and when the oil, soap and water have combined, one quarter of the weight, of fine black lead powder should be added. The second composition is merely hogslard and fine black lead powder; but both in this and the preceding, the whole art consists in having the very best black lead, in the purest state in which it can be procured. This is best done by first pounding the black lead and then washing it: pouring off the water, when all but the finest particles have settled to the bottom; and setting this water by till it deposits these particles, which alone are to be used. The first settlings may be again pounded when dry, and submitted to the same process as before. This has been found the only effectual method. Mr. Booth's

patent grease is much used and highly spoken of. It is tolerably hard when cold, and melts with a moderate degree of heat, which is a desideratum; it is composed of common soda half a pound, and water 1 gallon; to which 3 lbs. of clean tallow, and 6 lbs. of palm oil are added, or instead of these, 10 lbs. of palm oil, or 8 lbs. of tallow. The mixture is then heated to 200° or 210° Fahrenheit, and well stirred till it cools down to 66° or 70° Fahrenheit, when it is ready for use. Soft unguents, such as oil or hogslard, only do for light weights; with heavy ones, a thicker composition must be used."

[For the American Railroad Journal and Mechanics' Magazine.]

COST OF RAILROAD TRANSPORTATION.

We are very well pleased to see the Harrisburg Intelligencer endeavoring to enlighten the public in regard to transportation on a railway, as well as in regard to the comparative cost by steam and horse power. As they truly say, it depends upon the amount of tonnage, whether most economy will be found in the use of the one or the other, and as it may be as well expressed, whether it is a coffee or a grist mill that is required to be turned. A tonnage of or exceeding 20,000 tons, we should incline to believe, would generally be most cheaply moved by steam power, and under that limit by horse power. The subject for a comparison selected by the Intelligencer are not sufficiently analogous to draw from them any certain conclusion. The ancient railroad of 1830, and the modern one of 1840, have but few features in common. It is like comparing a jackknife and a razor, of which, all that can be said of them in common is, that they are both knives. As our estimates in these instances differ somewhat from the Intelligencer, we will append them, the subject being one, which cannot be kept alive and agitated without imparting some information.

The Danville and Pottsville railway.—This is but a half finished road, and is of the ancient order of flat bar, etc. The first cost of road and machinery must now go for nothing—the present limited business on it being done at little over mere cost only, for local accommodation. It transports 15 to 20,000 tons of coal per season to Sunbury 20 miles, equal to, say, 80 tons per day—the expense on which would be as follows;

1 locomotive in daily use for 250 days at \$13 per day, including only actual repairs,
40 cars daily on the road, repairs, attendance, and oil, 25 cents per car per day, is \$10 per day for 250 days,

\$3,250

2,500

— 5,750

Repairs to road are said to be about \$3,000 per season, which may well be, when those on the Minehill, in 1840, doing a business of near 180,000 tons were only \$3,200, using horse power for 16 miles. The cost by steam power is here then only, \$5,750, while doing the same business by horse power, is made to amount to \$6,325 by the *Intelligencer*. This company could not afford to transport at a loss, and with the addition of travel and back freight no doubt have a small surplus at the end of the season. An effort should now be made to renew and connect it with Pottsville, and by that means with Philadelphia, particularly as the State of Pennsylvania is guarantee for the interest on a portion of its cost.

The Roush creek and Harrisburg railroad, 35 miles.—This is a projected road, to be built solidly, and on which it is assumed 150,000 tons per season, or 600 tons per day, will be transported. The expense of which will be as follows:

1 locomotive in daily use for 250 days at \$16 per day,	
to include depreciation,	4,000
87 cars daily on the road, repairs, depreciation, oil and attendance, 50 cents per car per day, or \$44 per day,	
for 250 days,	11,000
	<hr/>
	\$15,000

or equal to 10 cents per ton, instead of 14 cents, as made by the *Intelligencer*, who makes his charges as if the road were operating the whole year, when by terminating at Harrisburg, it must go to sleep with the canals for four months—may it have a worthier termination at Philadelphia.

The above about accords with our estimate for the Minehill road at Schuylkill haven, by which it is seen the 260,000 tons carried over it in 1841, could have been transported by steam power at not over a fippenny-bit per mile, in place of 15 to 20 cents, which it must have cost by horse power, and yet we are told that the leading directors of that road, which has been lately relaid with a heavy rail, are scarcely yet persuaded of this fact. The 10 miles of this road accessible to locomotives, will now of course be used in continuation of the main stem from Philadelphia; otherwise its business will be transferred to Pottsville.

The following comparison of these powers, by steam and horse is from the *Intelligencer*, and is faithfully drawn:

“Horse power is better adapted to narrow limits, narrow means, and narrow minds—steam power annihilates time and space, and under the direction of mind and science, accomplishes great objects by great means. Horse power is the puny wheelbarrow, the cheapest and best vehicle to transport a single bushel from the canal to

the Susquehanna—steam power is the conestoga wagon, capable of transporting the burden of one hundred wheelbarrows the whole length of the commonwealth at less than one tenth of the expense. Horse power, is a pigmy, killing mosquitoes with his finger—steam power is Hercules, with his club, destroying the Lærnean serpent. Horse power is the simple bodkin in the hands of a child, to pry the meat of the walnut from its shell—steam power is the lever of Archimedes, to move the world."

[For the American Railroad Journal and Mechanics' Magazine.]

TRADE OF THE GREAT WEST.

A leading forwarding merchant, Mr. James O'Connor, of Philadelphia, explains the causes of the falling off of this trade on the Pennsylvania improvements in the season of 1841 particularly, and for its seeking the more circuitous one by those of New York. A remedy is also suggested by him worthy of the attention of those concerned.

It appears that, for the *spring trade*, destined to the Ohio and Mississippi, Pennsylvania is without a rival,—the route to Pittsburg being the cheapest and shortest,—there being no difficulty of getting from that point by the river prior to the 1st of July. After that date, the Ohio is generally navigable for keel boats only, which answer but for the down freight; the charge for carrying it to Louisville being \$25 per ton, and to Cincinnati \$22 50 per ton of 2000 lbs., performing the trip in 20 to 25 days, the charge by them for insurance is also *very high*.

Owing to these difficulties traders have preferred, *after July*, to forward through the New York works,—making their purchases mainly in that city, or when made in Philadelphia, the seller there has been obliged to pay the freight to New York, and the amount paid in that way the present season, he estimates at \$20,000, and and at least \$100,000 of tolls lost to the Pennsylvania works.

Thus do the Pennsylvania works lose considerably by this diversion; and besides, attention is now particularly called by Mr. O'Connor to a *new competitor*, the Boston and Albany railway, just coming into the field, and which aim to throw both the old horses, "New York" and "Philadelphia" off the track. This it takes the most effectual means of doing by using "the better improvement of the age," and putting its charges *at half the price* hitherto charged on other routes for the same distance,—thus:—On dry goods and other merchandise, per

Albany and Boston railway, 204 ms.	the charge is \$6 to \$10 per 2000 lbs.	new order of railway.
Camden and Amboy 87	do. \$10 and \$15	do.
Philadelphia and Baltimore 92	do. \$10 and \$12	do.
Philadelphia and Columbia 82	do. \$8	do.
Philad. and Chambersburg 156	do. \$15	do.

} old order of railway.

New York and Philadelphia will therefore be compelled to counteract this competition;—the first by the completion of the Erie railroad, and the latter by making her *middle route* of railway to Cleveland as soon as possible.

The remedy proposed by Mr. O'Connor to the interruption which now exists at Pittsburg, after the 1st of July, by the lowness of the water in the Ohio, is to dispense with the keelboats, which draw too much water, and to substitute in their stead "*scow modelled sheet iron steamboats*," capable of carrying 40 to 50 tons of freight, and to draw only 13 inches,—say, 180 feet long by 12 feet beam—which could make the trip to Louisville and Cincinnati in 4 to 5 days, at \$8 per ton, in place of the keel boats, which, when they can start, take 20 to 25 days, and charge \$22 to \$25 per ton. Twenty to thirty scow iron steamboats, to cost about \$5000 each, he estimates as enough to continue the summer and fall trade, and while the river is too low for the navigation of the larger boats.

The keelboats, as stated, not answering for the trade up the river or towards Pittsburg from Louisville, etc., it is directed into the Ohio canal at Portsmouth and thence to Cleveland or Lake Erie finds its way through the New York and Erie canal, and the transporters on the Pennsylvania works thus find this interruption from the low water at Pittsburg to cut both ways, and is as injurious as if a break in the canal had suspended navigation from four to five months in the season.

In the spring, goods are generally carried from Philadelphia to Pittsburg in six to eight days—by steam scows in five days to Louisville, or in all, 13 days, at an average charge of \$40 per ton through from Philadelphia, would ensure for this route, says Mr. O'Connor, a preference at all seasons from western merchants.

The tolls on the New York canals have this year increased some \$258,000, reaching a sum of nearly \$2,033,000, in which may be partly accounted for by the facts above given. There is ample trade now on this line to maintain these canals, particularly the Erie or main stem, which is fortunate, if we look to the day which will certainly come, when the railways on its line are left unrestricted, and the Erie railway is completed to Dunkirk. The actual tonnage from beyond Buffalo, and that going through from New York on the Erie canal, is of an amount which could be *easily and better* accommodated by the Erie railway alone, to say nothing of the assistance from those on its line, and hence to advocate the enlargement with only half its capacity even now filled, is the rankest folly. Nor should the competition from other States in drawing off a portion

of that which now helps to swell the toll on this canal, be overlooked by our legislators when they come to consider this matter of enlargement.

[For the American Railroad Journal and Mechanic's Magazine.]

RED ASH COAL.

Fuel and iron may be termed the keys to the arts as well as to all the substantial comforts in social life. As the advocates of whatever, therefore, throws any light upon this subject, we willingly publish the following account from the Harrisburg Intelligencer, giving some further particulars of the district in which the red ash coal more particularly abounds. The demand is as specific for this quality, as it appears the Pinegrove region is specifically that, where it is only to be reached in bodies under circumstances which will render it the cheapest to mine, and it is therefore, with the necessary facilities for placing it in market, even now a most legitimate object for investment and speculation, however abundant may be every other sort of coal. Now that the public mind has been so unsettled as to all other kinds of investments, capital may seek these mountains, and it may, therefore, not be long before this region is furnished with the requisite avenues to render it available. As every body now asks for "Peach Orchard" so will they then inquire equally for "Pinegrove" coal.

This quality of coal is sure to maintain a preference for domestic use, particularly where fine furniture is used, the ashes being heavier do not rise in the room when the fire is stirred—it more easily ignites, burns more freely, and will burn when only a small quantity is used; and besides the red ash coal does not injure the skin or chap the hands of those who make the fires, nor take the varnish from furniture like the white ashes. The great majority of all the red ash coal in the State, (Pennsylvania) lies in the deposits in the Swatara or Pinegrove region. There are five mountains of it running for more than 20 miles parallel through it, broken to their bases, by the Swatara and its branches, exposing the coal to view, in several places, like a ledge of rocks. There are also two mountains of white and grey ash coal on the north side of the basin. The veins of the red ash here vary from 3 to 20 feet in thickness, rising in tracts above the natural level in many instances more than 800 feet. In the Pottsville region the largest veins are only 5 to 7 feet thick and every good vein is worked out above the water level, and a drain of half a million of tons a year will soon take all the available red ash coal above 600 feet below the water level south of Minehill. It may therefore be anticipated that the whole Union will soon look to the Pinegrove region for its supply of red ash coal.

The distance for a railroad, over the most suitable grades on either side, would therefore be, from the grand centre, on Roush creek, to Harrisburg, 35 miles, to Reading 45 miles, and the locomotives will be able to run up to the very mines with full trains. The distance to Philadelphia would be 100 miles, *or as near to it as the great supply of the Delaware company, on the Norwegian above Pottsville, or on the west branch of the Schuylkill above Minersville.*

We may add that the demand for red ash coal being specific, the Pinegrove region, as the great repository of it, cannot fail to have enterprise and speculation very soon directed towards it.

In presenting the following opinion of the Hon. Mr. Beardsley, we feel a pleasure which is undoubtedly felt by every true friend of the cause—that, notwithstanding any doubts entertained upon the subject, the integrity and vitality of the New York and Albany railroad company is unimpaired, and that a fair prospect now exists for the completion of this most important “link” in our chain of railroads. We are also informed that contracts have been made with responsible and competent men for the graduation of the entire road from this island to the city of Troy.

We cannot omit this opportunity of complimenting those zealous friends of the work who have so perseveringly and faithfully continued to promote the advancement of this most important road by preserving through many difficulties, the valuable charter which they possess, and by stimulating the dormant energies of our capitalists to the important and profitable undertaking, which will both do credit as a work of private enterprise, and maintain the superiority of our city, in spite of the active competition of our neighbors.

The season is now approaching when our citizens are about again to experience the disadvantage of their too fond reliance upon our *natural* advantages. Nature is about to close with icy bonds our free communication with the interior, removing us for all purposes of transportation, several days journey from the outlet of all our public works, while Boston is within one day's travel by a continuous railroad to the city of Albany.

How our large holders of real estate in this city can thus quietly submit to a rivalry which is affecting them as surely and steadily as if their whole property were gradually removing into the interior, is to us matter of great surprise and regret. Let them remember, that this line of road places our city in direct communication with nearly every place of consequence in the State, and that laterally a communication is established with a large portion of our most fer-

tile and thriving territory—that by the Hudson and Berkshire railroad, we shall have an uninterrupted line of railroad through Boston to Portland in Maine—by the northern railroad to Canada, an avenue to that country—thus bringing together to one great centre the products, we had almost said, of different climates—let them remember all this, and then *can* they hesitate as to what course they are to pursue?

But in this view of the subject, we have omitted a source of traffic, which by itself is sufficient to support the work—we refer to the business to be derived from the region through which the road passes, and which for mineral produce, for agricultural wealth and magnificent scenery, is unrivalled. To the existing traffic, is to be added, the vast amount which will follow the increased population, both from active business men and retired citizens. Such a district will afford the greatest advantages on account of the ready access to the metropolis, and the man of wealth may enjoy the comforts of his residence during the whole year, being but a few hours removed from the gaieties, the news, or the libraries of the city, even in the depth of winter.

Such are a few of the benefits to be derived from this most necessary work—necessary alike to our comfort, our pleasure, and our profit; and if there is money, or enterprise, or *common sense* in the city of New York, its completion cannot be delayed.

OPINION OF THE HONORABLE SAMUEL BEARDSLEY RELATIVE TO

The Acts of Incorporation authorizing the New York and Albany railroad company to construct a railroad from the Island of New York, through Westchester, before the expiration of May, 1844, and to extend the road from Greenbush to Troy, together with branches to eastern points.

Opinion.

By an act of the Legislature of this State, of the 17th of April, 1832, "*The New York and Albany railroad company*" was incorporated, "with power to construct a single, double or treble railroad or way, betwixt the cities of New York and Albany, commencing on the Island of New York where the Fourth Avenue terminates at the Harlem river, and passing through the counties of Westchester, Putnam, Dutchess, Columbia and Rensselaer, and ending at some point on the said Hudson river, opposite or near the city of Albany." (Laws of 1832, p. 258, § 1.)

Such is the general designation of the terminating points and the route of the road, but the company was expressly empowered "to

continue and extend the same to the city of Troy;" and also "to construct a branch or branches to the eastern limits of each or any county or counties within this State, into which the said railroad may enter, where such branch or branches shall be necessary to connect said main road with any railroad already or hereafter to be constructed in either of the States of Massachusetts or Connecticut." (§ 1.) The charter of the company was to continue for fifty years.

It is expressly declared, that unless said corporation shall "within three years from the passage of this act, commence the construction of said railroad or way, and spend at least the sum of two hundred thousand dollars thereon," and "within ten years from the passage of" said act, "construct, finish and put" the same in operation, "then the right of the said corporation shall be null and void," (§ 2,) said section also particularly provides that "if a sufficient amount of the stock of the said company shall be subscribed within the county of Rensselaer, to construct and continue the railroad from the village of Greenbush to the compact part of the city of Troy, then the said company *shall* construct and continue said railroad to the said city of Troy, within four years after said amount of stock shall be subscribed therefor."

The capital stock of the company was to be three millions of dollars. (§ 3.) Books were to be opened within six months, and as soon as said stock should be subscribed, the company was authorized to organize by electing directors, but no subscription was to be allowed "unless five dollars on each share subscribed," were paid at the time of subscription. (§ 4, 5.) In addition to these, the ordinary powers to acquire title to the lands necessary for the work, construct the road, etc., were conferred on the corporation, and the directors were particularly required to make an annual report in detail, of their proceedings and expenditures, verified by the affidavit of at least two of their number, to be filed in the office of the Secretary of State. (§ 16.)

It is understood that nothing was done under this act prior to the passage of the amendatory act of 1836.

By the original act, the road was to be commenced, and at least two hundred thousand dollars expended thereon, "within three years," or the right of said corporation was to be void. (§ 2.) This had not been done, and the corporation had, of consequence lost all right to do any thing under its original charter, when the amendatory act of the 9th of May, 1836, was passed. (Laws of 1836, p. 373.)

This act is entitled "An act to amend an act, entitled 'An act to

incorporate the New York and Albany railroad,' passed 17th April, 1832." It extends "the time for commencing the construction of the New York and Albany railroad, for two years from the passage of said act, (§ 1.) and declares, expressly, that "such parts of the act hereby amended as may be inconsistent with the provisions of this act, are hereby repealed." (§ 10.) Thus, in effect, continuing in force and applying to said corporation, as revived by the amendatory act, such parts of the original act as were not inconsistent with the provisions of the amendatory act.

By the "*New York and Albany railroad*," as indicated in this amendatory act, must, in my opinion, have been intended, not only the road from New York to the Hudson river at Albany, but the road continued and extended to Troy, and such branches as were authorized by the original act of 1832. All these are regarded as parts of one and the same work, which was designated as "*The New York and Albany railroad*." If this view is not correct, it must follow that no authority has existed, at any time, to extend the road to Troy, or to make branches, except such as was conferred by the the original act, but which, I believe, has not been urged by any one. The amendatory act, it will be observed, authorized the commencement of the work, at any time within two years. It also authorized subscription books to be opened at any time within six months; and without waiting for the whole capital of three millions to be subscribed, as required by the original act, the company was authorized to organize by electing directors, etc., as soon as one million of dollars were "subscribed, and the first instalment thereon paid in." (§ 3.)

The original act, (§ 2,) required the road to be constructed, finished and put in operation, within ten years, or the right to make the same was to "be null and void," but the amendatory act declares, that "the said company are hereby authorized, after they shall have completed not less than thirty miles of said road in the county of Westchester, to commence the said road upon the Island of New York, with the consent of the corporation of the city of New York, and to construct the same in such sections as they may deem most eligible, and as fast as they may obtain means for so doing; and such portion of said railroad as may be so constructed, shall be vested in said company for and during the period allowed in the original act of incorporation." (§ 4.)

I understand this to be an unqualified authority to construct such parts or sections of the road as might be deemed most advantageous, except the part on the Island of New York, which could only be

made after completing thirty miles, at least, in the county of Westchester, and with the consent of the corporation of New York. But as to the other parts or portions of said road, they might be made at any time, and as made, title thereto would become "vested in said company," and that without any regard to the time when the entire work should be completed.

The amendatory act adopts and applies to this corporation "all the privileges and provisions which are granted to, and made in favor of the corporation created by the act entitled "An act to provide for the construction of a railroad from Attica to Buffalo," passed May 3d, 1836, and declares that it "shall be" subject to all the conditions and reservations which by the act aforesaid, are imposed upon the corporation therein referred to, except as herein provided." (§ 5.)

The act thus referred to, may be found in the laws of 1836, page 319. It is in the ordinary form of railroad charters of that year, and it is not deemed necessary for the purpose now in view, to make particular reference to any of its provisions. They seem not to bear at all upon the present question.

A further amendatory act, was passed on the 12th of May, 1837. (Laws of 1837, p. 456.)

At that time, nothing had been done towards organizing the company. By this act the company was authorized to organize by electing directors, "as soon as seven hundred and fifty thousand dollars shall be subscribed, and the first instalment paid thereon." (§ 3.)

This act required the corporation to commence the work within two, and expend three hundred thousand dollars thereon within three years from its passage, and within five years after its passage "complete the said road so as to unite, at some convenient point, with the line or lines of railroad running to Greenbush and Troy, or the right of the said corporation to continue the said road" should cease. (§ 1, 3.)

By this act, several important alterations were made in the charter.

1. The corporation had time to *commence* the work until May 12, 1839.

2. The company might organize as soon as seven hundred and fifty thousand dollars were subscribed, instead of a million, as required by the act of 1836.

3. Three hundred thousand dollars were required to be expended on the road, by the 12th of May, 1840.

4. It was to be completed to a certain extent, by the 12th of

May, 1842, or the right of the company to *continue* the road, was to cease. A failure, however, to comply with these requisitions, would not necessarily, annul the corporation or forfeit all its rights, for notwithstanding some of them might be violated, such parts or sections of the road as might be completed, would remain "vested in said company for and during the period allowed in the original act of incorporation," as is provided in the fourth section of the amendatory act of 1836. This, it is plain, might be the result, although the company had lost all right to *continue* and *complete* the road.

It is said the company was duly organized under the act of 1837; on the 2d of May, 1838, the sum of seven hundred and fifty thousand dollars having been subscribed towards the capital stock, directors were chosen, and have been continued by subsequent elections, and it is assumed that annual reports, etc., have been regularly made. In these respects, there seems to be no doubt that the corporation was legally organized and conducted; and I do not see that any objection of this nature has been urged against its present existence or powers.

The next legislation on this subject, was an act of the 18th of April, 1838. (Laws of 1838, p. 299.)

This act declares that "the time for the commencement and completion of the New York and Albany railroad, is hereby extended two years." The road, was, therefore, to be *commenced* by the 12th of May, 1841, and *completed* by the 12th of May, 1844,

Another amendatory act was passed on the 16th of April, 1839. (Laws of 1839, p. 158.)

This act adopts certain provisions in another railroad act, which relate principally, to the mode of acquiring title to the land for the road, and applies them to this corporation. These need not be particularly stated. The second section, however, of this act of 1839, is highly important, and should not be overlooked. It authorizes the New York and Albany railroad company, "to locate, secure titles and construct their road, in such sections as they may deem most eligible, and as fast as they may obtain means for so doing, within the time limited by law for the construction of the said road;" and it declares that "such portions of said road as may be constructed, shall be vested in said company, for, and during the period allowed in the original act of incorporation." (§ 2.)

This, in substance, is a repetition of part of the provisions in the fourth section of the amendatory act of 1836. That section, it will be observed, prescribed certain conditions, as prerequisites to the

construction of the road upon the Island of New York, although it gave, as I have supposed and suggested, an unqualified power to construct the residue of the road in parts or "sections," and vested title to the same in the company, as they might be completed. But this act of 1839, seems to have removed *all* restrictions and conditions, giving to the company absolute and unconditional power to "*construct their road in such sections as they may deem most eligible*," and vesting title thereto "in said company for" the period limited in the original act.

These are the only legislative acts which bear upon the question of the present existence and general power of this company. There is another act* which has been supposed, more or less, to affect the extent of the rights of this corporation, but in no degree its existence or general powers. How far, if at all, the act "relating to the New York and Harlem railroad company," may have curtailed the rights and powers of "the New York and Albany railroad company," as to a part of the line in Westchester county, (and no one pretends it can have any effect—further up the Hudson,) is a point upon which others have advised, and no opinion is of asked me, I have therefore not examined that question.† But my opinion has been requested "in relation to the existence of the charter," and as I understand it also, upon the general powers of the New York and Albany company, and I must say that upon the act, before particularly referred to, I see no ground on which the existence of the charter and general powers of this company can well be drawn in question.

We have seen that the company was, by its original charter, authorized to make and construct a railroad from New York to Albany, with power to extend the same to Troy, and make lateral branches at certain places, the time originally limited, for the commencement and completion of the work expired, but was extended from time to time, so that by the last act on that subject, the road was to be *commenced* by the 12th of May, 1841, and *completed* by the 12th of May, 1844. (Act of 18th of April, 1838.)

The road was commenced, and considerable progress made in

* "An act relating to the New York and Harlem railroad company. Passed May 7, 1840."

† Upon this point, the opinions of David B. Ogden, Charles McVean, John Anthon and Jonathan Prescott Hall, were previously given, fully sustaining all the rights and privileges of the New York and Albany railroad company, in and through the county of Westchester, and stating "that the right of the New York and Albany railroad company to construct a road commencing on the island of New York, through Westchester, is not in any manner impaired by the act of the 7th May 1840," "relative to the New York and Harlem railroad company."

the work, as I learn, prior to the 12th of May last, the time limited for its commencement. Upon what principle then, can it be doubted that the company have a right to go on and complete the road by the 12th day of May, 1844? I confess I perceive no ground for any such doubt.

1. But it is said that the act of 1837 required three hundred thousand dollars to be expended on the road by the 12th of May, 1840, and that this was not done, and therefore the charter is at an end. It is true such an expenditure was required by that act, which also required that the work should be *commenced* by the 12th of May, 1839. But the act of the 18th of April, 1838, extended the time for the *commencement* of the work to the 12th of May, 1841, and thereby, necessarily, annihilated the obligation, imposed by the act, to *expend* three hundred thousand dollars by the 12th of May, 1840. It would be inconsistent, not to say grossly absurd, to allow until the 12th of May, 1841, for the *commencement* of the work, and still require an expenditure of three hundred thousand dollars, or any other sum a year, prior to that time. I think it very clear, therefore, that the clause requiring this expenditure of three hundred thousand dollars to be made, was wholly abrogated by the act of 1838, which has been referred to. The provisions are inconsistent and both cannot stand; the first must therefore yield to the last, upon a principle of universal law. This would seem to be in accordance with common sense, as it is a plain principle of law. Blackstone says an "old statute gives place to a new one," "where its matter is so clearly repugnant that it necessarily implies a negative." (1 Black. Com. 89.) Giving time to *commence* the work until May, 1841, *necessarily* implies that a large *expenditure* could not have been required a year previously to that time.

2. Nor is there, as it seems to me, any difficulty, as may have been supposed, growing out of the words of the act of 1832, which, after authorizing the construction of the road from the Island of New York, to "some point on the said Hudson river, opposite or near the city of Albany," proceed as follows, "with power to *continue* and *extend* the same to the city of Troy." (§ 1.)

It has been suggested, that the road can only be made from Greenbush to Troy, after the main work has been completed up to the former place; that then, and not before, the power will arise, to "*continue* and *extend* the same to the city of Troy." But this could not have been the meaning of the original act of incorporation, for that required, *peremptorily*, that the road should be constructed and continued from Greenbush to Troy, within four years after certain

stock should be subscribed, (§ 2,) (a provision in my opinion, still in full force,) although the charter allowed ten years for the *completion* of the entire work. It might, therefore, become the imperative duty of the company to make the road between Greenbush and Troy, although the road had not been completed up to, or within fifty miles of Greenbush.

But the amendatory act of 1836, not only extends "the time for commencing the construction of the New York and Albany railroad," (§ 1,) (by which I understand the entire road from New York to Troy with its branches as authorized,) but declares, expressly, as to the whole line, except a part in the county of Westchester, and on the Island of New York, that the company may "construct the same in such *sections* as they may deem most eligible, and as fast as they may obtain means for so doing; and such portions of said road as may be so constructed, shall *be vested in said company* for and during the period allowed in the original act of incorporation." (§ 4.)

Similar language is used in the amendatory act of 1839, which authorizes the company "to locate, secure titles and construct, their road in such sections as they may deem most eligible," etc.

"*Their road,*" is the language used to describe the work to be done,—*that*, may be located and constructed in "*sections.*" What road is thus referred to? Certainly not the road from New York to Greenbush only, but that road continued and extended to Troy. This, at least, is my understanding of the language used. In my opinion, therefore, the corporation is still in full life, with power to construct the road, in *sections* or *otherwise*, as has been fully explained.

SAMUEL BEARDSLEY, O

JOHN DELAFIELD,

GEORGE R. DAVIS,

JONAS C. HEARTT, Esqrs.

*Committee of the Directors of the New York
and Albany Railroad Company.*

UTICA, December 2, 1841

PENNSYLVANIA AND OHIO CANAL.

We give place with pleasure to the following abstract, from the report on one of the most important links in the chain of the Pennsylvania improvements, as indispensable in securing her an equal portion, and would be the means of placing her indeed on higher grounds than all the other eager competitors for the western trade:

unhappily for her it is yet in an incomplete or rather dilapidated state. It should be well looked to as a likely means hereafter, of relieving the plethora which the Erie canal has been of late years suffering under, and which is made the plea for so much outcry for the measure of enlargement, in so many other respects, useless. To justify such an expenditure, an honest representative must satisfy himself:

1st. That the Erie canal has ever been filled when in good order beyond the one-half of its full capacity, estimating it at 56,000 lock-ages.

2d. That the railroads on the line of this canal, which in July next, will connect Albany and Buffalo, are to be for ever prohibited from *assisting* the canal to carry freight.

3d. That the Erie railroad, on which near \$3,000,000 of the public money has already been spent, is to be abandoned, and its completion given up, as it would otherwise take nearly all the valuable *through trade* at either end, from the canal.

4th. Whether the section of the State through which the Erie canal and a line of railroad now passes, has not been sufficiently pampered with this consequent enormous outlay of near \$25,000,000, and whether, therefore, the outlay of another dollar can be justified except on the direst necessity, and until after other portions of the State, having an equal claim, have had their just proportion of the State patronage.

There is a disposition to *log roll* in regard to these two main works, the Erie enlargement and the Erie railroad, but if the coming legislature will justify its title of *democratic*, let them kill at once all such squinting.

The sixth annual report of the directors of the Pennsylvania and Ohio canal company to the stockholders:

The whole extent of navigation created by the improvement is substantially as follows—

Length of main canal from Beaver canal to Ohio canal	
and Akron	84 miles.
Length of Cuyahoga feeder, made navigable	10 "
Length of slackwater above the dam	4 "
Length of Middlebury side cut	1 "
Making the total extent of navigation about	99

The amount of lockage on main line is 420 feet, overcome by 54 locks and 15 feet on the feeder and side cut requiring those locks. There are 2 aqueducts, 80 culverts, 75 bridges and 9 dams. One of the aqueducts, 2 dams, nearly all the locks and culverts, are of cut stone masonry laid in hydraulic cement. The company has also provided and furnished four new substantial covered boats with

furniture, cooking implements, bedding, etc., for the convenience of boarding and transferring hands from one point to another along the line, and the necessary stone boats and other machinery and tools for making repairs as occasion may require.

The whole of these expenditures are charged in the foregoing account of work or contingencies and it is found in practice, that repairs are made with greater facility and much less expense than in any other mode.

The whole amount of expenditures including work, all contingent expenses, damages, superintendence, repairs and boats, up to the present period, will not exceed \$1,256,000, being less than \$13,000 per mile for each mile of navigation created.

The subscriptions of stock from which the foregoing collections have been made, are as follows:

In the city of Philadelphia,	-	-	-	-	-	\$623,780
From the State of Pennsylvania,	-	-	-	-	-	50,000
From the county of Alleghany, Penn.	-	-	-	-	-	50,825
From Beaver and Mercer counties, do.	-	-	-	-	-	46,360
From Trumbull county, Ohio,	-	-	-	-	-	51,042
From Portage county, do.	-	-	-	-	-	22,470
From the State of Ohio,	-	-	-	-	-	420,000

Total amount of collections credited to stock,	-	\$1,264,477
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Although the original design, contemplated by the charter of the company, of forming a continuous canal from the Ohio canal at Akron to the main line of the Pennsylvania canal, at or near Pittsburg, has not yet been accomplished, still the amount of business which was immediately secured, and which has been so rapidly augmenting, since this communication has been thus partially opened, demonstrates its present importance, and evinces the wisdom and utility of the original project. By subjecting this line of communication between Pittsburg and Beaver, a distance of twenty-six miles, to all the fluctuations and interruptions of the navigation of the Ohio river, not only suspends its business during the time its waters are too low for steamboat navigation, but by rendering it uncertain and insecure, drives much of the commerce between the Atlantic cities and the west, into other channels which would otherwise flow into this. It also incurs the additional expense of transshipment, storarge, and drayage, or by compelling the freight to pass into the hands of extensive transportation companies, having the control of steamboats upon the river, creates a monopoly, against which, individual enterprise cannot successfully contend, the natural tendency of which, is to keep up the price of transportation at unreasonable rates.

Let this communication be once opened, so that boats could pass from any point on the Ohio canal to Johnstown, where they could secure a return cargo, its business would be doubled, and individual enterprise would reduce the cost of transportation in the same ratio. So well satisfied were the directors, by a comparison of the prices of transportation with those on the Ohio and New York canals, that this reduction could be sustained on the Pennsylvania improvements,

that inquiries were made of some of the principal merchants in Pittsburgh, from whom information was obtained that by making separate contracts with individuals owning boats upon each side of the mountains, they procured their goods to be brought from Philadelphia to Pittsburgh at about half the customary charges of the transportation companies, and that the carriers were well satisfied with the stipulated prices and anxious to secure their business. Such has been the disparity in the cost of transportation, compared with distances, that contracts have been made for the delivery of merchandize the present season from New York to Pittsburgh, by way of the New York, Ohio, and crosscut canals, a distance exceeding eight hundred miles, at one dollar and forty cents per hundred; while the customary charges by the transportation companies for the same articles from Philadelphia to Pittsburgh, less than half the distance, have been greater. This disparity in prices cannot have arisen from excess of tolls, or any expenses of transshipment to which the latter route is subjected more than the former.

On the former route, transshipments are required at Albany, Buffalo, and Cleveland, and were the whole amount of tolls remitted on the latter, the disparity although lessened, would still be apparent. These facts are presented to show the reason why the wheat, flour, and other productions of Beaver, Mercer and other counties bordering on the Pennsylvania and Ohio canal, have taken this circuitous route to market in preference to the shorter, quicker and safer one to Philadelphia or Baltimore. The same system of monopoly formerly existed on the New York and Ohio canals, and a simultaneous reduction, (by agreement of the officers having them in charge,) of twenty-five per cent. on the established rate of tolls on each, caused no reduction in the cost of transportation, until discriminating tolls were assessed, increasing with the increased charges for transportation. These measures, and the numerous individuals who have vested their small capitals in boats navigated by themselves in carrying the surplus produce of their immediate neighborhoods to market, and bringing merchandize in return, have reduced the cost of transportation on those canals to its present low standard, by which they retain the carrying trade against such fearful odds in point of distance.

The amount of tolls collected the last year was \$13,250; this year, up to the forepart of November, the receipts amounted to more than \$26,000, with a reasonable expectation that they would reach \$30,000 before the close of navigation.

In consequence of the bad condition of the Beaver canal, though a portion of which the business of this canal must pass to reach the Ohio river, the navigation was interrupted by low water and other obstructions to such an extent, that boats having more than half or two-thirds of a load could not be passed during the month of July. On application to the Canal Commissioners of Pennsylvania to remedy this evil, although stating that they had no funds at command appropriated to this object, they promptly gave directions to the engineer and superintendent having it in charge, to make such repairs as should be necessary to sustain the navigation through the

season. A compliance with these instructions necessarily required the water to be drawn off, by which the navigation was suspended most of the month of August, nor was it in a condition to pass boats fully laden until the fall rains caused a rise in the streams. These interruptions not only diminished the receipt of tolls for the time being, but by compelling the forwarding and other merchants to give different orders for the transportation of goods, seriously injured the reputation of the line, and affected its business through the season.

There can be no doubt that these causes have lessened the amount of receipts the present season at least twenty-five per cent., and there is much reason to apprehend that the imperfect and insecure condition of that work will effect still more injuriously the business of this canal the ensuing season. Very extensive repairs are required to keep up the navigation upon it for any length of time—to do this, will require the water to be drawn off, and consequently a suspension of business on the cross cut canal, until the repairs are completed.

Notwithstanding these causes have tended to lessen the business and receipts upon this canal the present year, still if its utility and productiveness can be tested by a comparison of these items with those on the Ohio canal from the first year of its operations down to a later period, we have good reason to be satisfied with its future prospects.

The Ohio canal was opened about fifty miles south of Cleveland in 1827—was extended in 1828 about one hundred miles, and in 1832 was opened the whole distance to the Ohio river, about three hundred miles.

The following statement of the amount of tolls received on that canal is taken from the Canal Commissioner's reports:—

In 1827 the amount of tolls received was	-	-	\$1,500
1828	"	"	4,000
1829	"	"	7,000
1830	"	"	30,493
1832	"	"	79,982
1836	"	"	211,823
1838	"	"	382,135

In 1840 the Ohio canal yielded an income of about seven per cent. on its cost of construction, over and above all expenses of superintendence and repairs for the current year.

The rates of toll established on this canal are, on most articles, materially lower than those on the Ohio canal, and are not intended to exceed them in any case.

The following list of articles, taken from the collector's returns, comprises the principal items of business in which tolls have been charged during the present season up to the 1st of November:

Merchandise, including iron, glass and nails,	10,620,247 pounds.
Butter and cheese,	1,516,977
Pot and pearl ashes,	1,222,987
Pig iron,	1,016,000

Iron ore,	2,346,000 pounds.
Extra baggage and furniture, -	301,000 "
Flour, -	36,500 bbls
Salt, -	12,486 "
Fish, whiskey, beef and pork, -	1,610 "
Wheat, -	147,124 bushels,
Mineral coal, -	377,000 "
Number of passengers, (returns from one office only received,) -	1,394
Number of miles conveyed, -	68,040 miles.

Most of these important items, such as merchandize, wheat, salt and coal, have increased in amount more than one hundred per cent. on the last year.

[From the American Journal of Science and Arts.]

**STEAM NAVIGATION TO THE PACIFIC BY THE ISTHMUS OF PANAMA, AND
ALONG THE WESTERN COAST OF SOUTH AMERICA.**

Some interesting pamphlets on the subject named in the title were placed in our hands early in 1840 in Boston, by a brother of Mr. William Wheelwright, to whom mainly the world is indebted for an undertaking which may be with propriety ranked the first among the enterprises by steam. Mr. Wheelwright has labored several years at this undertaking and is now on the eve of success. From himself we have just received a communication, which, although not intended for the public eye, contains many facts in which the world is interested, and we therefore venture to annex certain portions of his letter or abstracts from it.

[To Professor Silliman.]

TALCAHUANO, March 8th, 1841.

DEAR SIR: I had the honor of receiving your valued favor only a day or two since, having left the United States about the time it was written, to take up the superintendence of the Pacific Steam Navigation Company, which I had previously formed in England. Two of our steam ships, of about seven hundred tons each, the Peru and Chili, arrived in this port in fifty-five days from England, passing through the Straits of Magellan, from sea to sea, in thirty hours: sails were employed when the winds were fair, otherwise steam, and the voyage may be said to have been one of the most brilliant ever undertaken. The field for steam navigation in these seas is so ample that our first voyages came off most successfully, proving and fulfilling every statement made: unfortunately, however, the directors in England, neglecting to send a supply of coal, as previously arranged, the operations of the company have ceased for the present, and I am now engaged in this place in mining for coal, an operation never before undertaken in this country, and which, of course, presents a thousand difficulties. My first object when I arrived here, was to make a practical examination, to ascertain the strength of the coal, and see its influence upon our boilers

and fire bars ; for this purpose I proceeded south, with the double object of proving the coal and exploring Valdivia and the island of Chiloe. After some unsatisfactory experiments, we finally came to such an arrangement of our fire bars as to produce a result decidedly favorable ; the access of expenditure over the best Welsh coal was twenty-seven per cent., which is nearly as good as Newcastle coal. The formation of clinker is great, but it is not of an adhesive character, and the fires are easily cleared ; the coal seems to possess no sulphur, and there is nothing disagreeable in the smoke ; the ashes are white, and the coal free from smut. The coal lies in horizontal strata, rising or falling not more than ten or eleven degrees ; is about three to four feet wide, and is found, most generally, cropping out on the precipitous sides of hills : the upper stratum is generally soft ; the next stratum, which is what I now send you, is found from twenty to forty feet beneath ; and I am now engaged in sinking a perpendicular shaft for the purpose of finding a third stratum and still better coal. Some two or three cargoes of this coal have been shipped, and spontaneous combustion has been produced, which set fire to the vessels ; it must be considered that the coal first used was never mined, and was taken merely from the surface. I have ascertained that in two instances the vessels which have been set on fire had vegetable matter on board—the first was a cargo of wheat stowed over a deep bed of coal : the next, the coal was shipped in what are called here *chequas*, made of grass. What influence they may have had in producing spontaneous combustion it is not in my power to say, and I should be much obliged if you could account to me for its spontaneous ignition. I cannot at present make any large deposit of this coal until I make some experiments, and for this object I shall load one or two small vessels with the coal, and watch it carefully, keeping it free from any vegetable matter, and from water, and giving it all the ventilation in my power, it is a great drawback upon my operations at present. On board the steamers we have iron bunkers for about ten or eleven day's fuel, and it causes me no anxiety in putting it on board. I had this arrangement of our bunkers made with a view of using this coal.

On my voyage south, I found at Valdivia and Chiloe the same strata of coal, and in a line of coast of more than four hundred miles, there does not appear to exist the slightest difference in quality. It is perhaps worthy of remark, that the coal found at Boca del Toro, on the Atlantic side of the isthmus of Panama, and near Cherokee on the Pacific side of the isthmus, is the same to all appearance as that found in this district.

I am at present mining about fifty tons a week, but hope in the course of a few days to open some more mouths, and mine in much farther than I am doing at present ; my only fear is that in sinking a shaft I shall be obliged to contend with a large quantity of water. As it is a new thing, and a work in which I have no knowledge, I am obliged to adopt a common sense view of it, and work on as well as I can, until miners can be sent me from England. The cost at the pit's mouth will not exceed two dollars per ton ; should I get it

lower down, it will be necessary to clear it of water by a steam engine, which will render it somewhat dearer. Notwithstanding our operations are paralyzed at present, I feel persuaded that by the end of this year our line of intercourse to Panama will be completed, and our communication with North America and Europe greatly facilitated.

I have no doubt that the coal beds here will bring about sooner the steam intercourse westward from Europe to Australasia: this has been a favorite plan of mine for several years, and I hope that the arrangements which I made before I left England, patronized by Sir Edward Parry, Captain Fitzroy, Mr. Montague and others, will soon go into effect. Perhaps the greatest change ever effected will be produced by opening an intercourse westward from Europe to Asia, and making America the stepping stone between them. The isthmus of Panama is destined to become one of the most interesting spots in the world: a ship canal will be formed, and it will become the highway between the Pacific and Atlantic oceans. I have been frequently on the isthmus, have passed often between the two seas, have examined with much attention the facilities and obstacles which it offers for the object proposed, and have satisfied myself of the perfect feasibility of establishing a communication between the two oceans. On leaving England, I was requested to report upon my journey over, and to examine the isthmus with care, as well as the river Chagres. As it may, perhaps, be acceptable, I extract from the report such parts as I conceive may prove interesting to you.

"Having prepared myself with the necessary apparatus, I commenced by sounding the Chagres bar, where I found at low tide fourteen feet of water; the river being then swollen eighteen inches, left twelve and a half feet of water, from thence upwards to the junction of the rivers Chagres and Trinidad, (which you will find in the map in my pamphlet,) where there are four and three fathoms close to bank, which vessels might use as a pier to discharge goods. A little above the junction, the water shoals to seven or eight feet—the channel below is never less than three hundred to four hundred feet, and often one thousand to twelve hundred feet; a steamer of five hundred tons, properly built, might navigate as high up as the Trinidad, with perfect safety and ease; at this point it is also perfectly healthy; from this junction the distance is twenty eight-miles to the Rio Grande, which empties into the Pacific about three quarters of a mile from the city of Panama. Vessels of any size may enter this river, as the tide rises in spring twenty-two feet; the space between the two points has but a very slight rise. I should say that it could not exceed forty feet, for, in passing over to Panama from Gorgona, I found there was not a hill to ascend, and that a good carriage road could be formed without making a single cut. While the land to the left towards Cruces was mountainous and broken, that to the right seemed to decline to an unbroken plane; hence, it appeared to me, that Lloyd's statement respecting that line was strictly true.

"My impression is, that the first object, before thinking of

a canal, should be to make a good road from the junction of the rivers Trinidad and Chagres to the Rio Grande or Panama; by this means an intercourse between the steamers on the Atlantic and the steamers on the Pacific could be affected in three or four hours with perfect ease, and a cargo even transported in that time."

As it regards steam navigation in the Pacific, I feel convinced that it will gratify you to know, that the great work is going on. Even the few voyages made between Chile and Peru have shown, so palpably, its advantages, that the stopping of the steamers has produced a great sensation throughout the land; it is impossible to form an estimate of what it will do for these countries—the governments of Chile, Peru and Bolivia, have granted every protection and continue to give me every support; and I am under the firm conviction that when once perfected, its advantages will be found vastly beyond what I have described them. I am very much indebted for the insertion in the American Journal of Science of my paper on iron steamboats. I have made considerable efforts to bring forward that subject in England; I have gone into its detail and examined with all minuteness the whole subject, and I am perfectly convinced that not only all our western waters will be navigated by steam vessels built of iron, but that trans-atlantic steamers will and must be of iron. Mr. Brunel, the celebrated engineer of England, wrote me a letter of thanks for the paper, and promised to lay it before the board of directors of the Great Western company, and I have reason to believe that it was mainly instrumental in bringing about the building of the great iron steamer, which will shortly ply across the Atlantic, and show herself as vastly superior to the Great Western, as the Great Western was superior to others when she commenced trans-atlantic navigation.

[To Mr. Wheelwright.]

NEW HAVEN, July 20, 1841.

MY DEAR SIR: I am much gratified by your very interesting letter of March 8th, received yesterday, with two specimens of coal, for which I thank you. You rightly judge that I feel a deep interest in your project, which I consider to be one of the most interesting that has ever been undertaken. Your present mining operations are of the utmost importance, and their success must, I should suppose, be decisive of that enterprise; it must be too expensive, one would think, to bring coal from England, and it is most happy that Providence has supplied it in such immense quantities in the very regions where it is wanted, not only for navigation coastwise, along your immense ocean barrier from Panama to Patagonia, but for the supply of those points in the Pacific—Gallipagos Islands, Sandwich, Otaheite, etc., where depots will anon be established for the navigation of the Pacific, and eventually around the world. Your South American coal is a treasure of inappreciable value, and with the aid of trained English miners and engineers, I cannot doubt you will succeed. I dare say, however, that your New England "common sense," will suggest expedients that do not always occur to those who have been

trained to move in a beaten track. Can you not drain your water out at a lower level, by carrying in galleries connected by shafts? You do not say which way your strata incline—if towards the declivity of the hill or mountain in whose sides the coal crops out, then your drainage will be easy. You will of course look out for vallies and gorges, and all those positions to which you can make a communication so as to have the water go off by gravity—for even a long tunnel may be a less expense in the result than a steam engine, and it is vastly more simple and easy in the management. I have made some little blow-pipe experiments upon the coal you have sent me; that from the upper layer appears more like lignite, which you know, is merely wood of trees, altered by time, pressure, and fermentation. The lower stratum is good bituminous coal, and from the abundant flame with which it burns, it must be well adapted to produce steam. It is very probable, that your next stratum below will be still better, as having undergone a more perfect assimilation, for you are aware that the true coal, (as distinguished from lignite,) is also a product of vegetable decomposition, but the plants were of a much earlier date, and in general not composed of firm woody fibre, but more soft and succulent. It would require extensive and skillful geological observations on the spot, to decide whether you have the true bituminous coal formation of Europe and of North America, or a coal of a more recent date and less perfect—for such coals there are, as that at Brora in Sutherland, Scotland. The lignite belongs to the tertiary formation, a much more recent deposit than even the newest coal; but you may have a tertiary reposing directly upon the true coal formation. If your coal beds are of the more recent formation—which is very possible, (although I would not hazard an opinion from seeing merely hand specimens,) then it will never be as good as the true coals of an earlier geological date; still, however, you must mine it at all events, as it is your only resource, (wood being I suppose out of the question;) it is certainly well worth mining, and judiciously managed, will no doubt yield you a good result.

As to the spontaneous combustion, it is probably occasioned by the fermentation of iron pyrites, (sulphuret of iron;) which, in the present case, is abundantly visible to the eye, and where invisible, may be disseminated in minute and thin flakes and points through the body of the coal. It is very prone to absorb oxygen from the air and from water, and thus to heat and inflame. Your security, as I conceive, will be to lay out your blocks of coal in the dry, warm air, so as to have them thoroughly dry before they are shipped; and if it ever rains where your mines are, the coal after being above ground should be housed. In the ship, the coal should not be in contact with wood; if your bunkers are not all of iron, those that are of wood can be lined with stout sheet iron, and the coal should be covered from the air, especially the damp air of the sea, and the spray; if protected by wooden covers they should be lined with black tin, (thin sheet iron as prepared for tinning.) I mention this because it is light, and covers ought not to be too heavy; but no combustible thing should lie in contact with the coal—certainly not wheat or grass as you mention, or any other vegetable. You will

of course, reject any large visible masses of pyrites from the coal; any masses that are *visibly sprinkled* with it, you will also throw away; the English miners call the pyrites *mundie*. With these precautions, I do not believe your coal will spontaneously ignite, and should it do so, it will burn so slowly that it can be kept under till you make a port. I should remark that the small coal should never be taken on board, as being much more liable to ferment; they may be consumed in the engines on shore.

(From the Civil Engineer and Architect's Journal.)

ENGINEERING WORKS OF THE ANCIENTS.

Works of Hercules.—Besides the performance of the Egyptian Hercules already mentioned, Diodorus Siculus, Book 4th, gives an account of several works of the Greek Hercules. Not to speak of the operations attributed to him at the straits of Gibraltar, there were two hydraulic works in Greece said to have been executed by him. The large champain country about Tempe being all over a stagnant lake, he cut trenches through the lower grounds, and through these trenches drained all the water out of the lake, by which means were reclaimed all the pleasant fields of Thessaly as far as the river Peneus. In Beotia he did quite the contrary, for to punish the Minyæ, it is related that he caused a river to overflow the whole country, and turn it into a standing pool. In his passage of the Alps from Gaul, an expedition in which he was the predecessor of Hannibal and Napoleon, he leveled and opened the rough and difficult ways to make way for his army and carriages. In Italy, Hercules performed some remarkable works about the Lake Avernus, for whereas the lake extended as far as the sea, Hercules is said by casting up the earth, to have stopped up its current, and to have made the way near the sea, called the Herculean way. In Sicily to express his good wishes for the inhabitants, he caused a pond or tank to be sunk near the city of the Agrineans, four furlongs in compass, which he called after his own name. In Greece, Hercules had the further merit of having diverted the river Achelous into another channel which he had dug for it. This irrigated a considerable part of the country, and was done to please the Calydonians. It gave rise to the poetical fable that Hercules fought with Achelous transformed into the shape of a bull and in the conflict cut off one of his horns and gave it to the Etolians. This they call Amalthea's horn, in which the poets feign that there grows all manner of summer fruit, as grapes, apples, and such like, not the only time, by the bye, that engineers have filled the horn of plenty.

Dedalus.—Engineering Festivals.—Diodorus gives a long account of Dedalus, from which we have made the following extracts. Dedalus was an Athenian, of the family of the Erechthidæ, being the son of Hymetion, son of Eupalamus, son of Erechtheus, king of Athens. He was extraordinarily ingenious, and very studious in the art of architecture, an excellent statuary and engraver upon stone, and improved those arts with many noble inventions. Dedalus was

obliged to flee to Crete for the murder of his nephew Talus who was killed by him out of envy. To Dedalus is attributed the invention of sails for ships. After leaving Crete, he staid with Cocylus and the Sicilians, in whose country Diodorus, a native, says that works of his were to be seen in that day.

While on the subject of Dedalus we must not omit what the Biographic Universelle says on the subject of festivals established in his honor. When the Plateans returned to their native city, 311 B. C. after an exile of sixty years, they instituted an annual festival called Dedalia, which every sixtieth year was celebrated with extraordinary magnificence. All the trees cut down were made into statues called Dædala. The name of Dedalia was also given to a Theban fete in honor of the reconciliation effected between Jupiter and Juno by Cithero.

Talus.—Talus is sometimes called Atalus, Calus, and Acalus; he was the nephew of Dedalus, as before mentioned, and murdered by him. Being the son of Dedalus's sister, and but a young boy, he was bred up with his uncle to learn his trade. Talus, for ingenuity, exceeded his uncle, and invented the potter's wheel; he got likewise a serpent's jawbone, and with it sawed a little piece of wood asunder, then in imitation of the tooth in the jaw, he made the like in iron, and so he found out an instrument for sawing the greatest pieces of timber. He invented likewise the turner's lathe and many other tools.

Prometheus—Cretan Hercules—Vesta—Minerva—Vulcan.—Prometheus is according to some the first who stole fire from the gods, and bestowed it upon men (Book 5th.) but the truth is, he found out the way how to strike fire out of flint or stone. The Idæ Dactyli are also said to have found out the use of fire. They discovered the nature of iron and brass to the inhabitants of the Antisapterians, near the mountain Berecynthus, and taught the manner of working it, and because they were the first discoverers of many things of great use and advantage to mankind, they were adored and worshipped as gods. One of them they say was called Hercules, a person of great renown. After them were nine Curetes who invented swords and helmets. Vesta invented the building of houses, and upon this account almost every body sets up her statue in their houses, and adores her with divine honors. Minerva was the introducer of architecture, and also according to our chronicler of the use of garments, so that architecture and tailoring according to him boast one common parent. Vulcan they say found out the working of iron, brass, silver and gold, and all other metals that require forging by fire; and the general use of fire in all other cases was found out by him.

Xerxes—Agrigentum—Pheax—Themistocles—Diversion of the Nile.—The eleventh book of Diodorus, is on Greek history, he mentions Xerxes throwing a bridge over the Hellespont, and cutting a canal through Mount Athos.

The Agrigentines in Sicily having acquired great spoil by the defeat of the Carthaginians, took the greater part of the prisoners into the public service, and employed them in cutting and hewing stone. They not only set them to build the largest of the temples, but made water courses and sewers under ground, so great and wide, that though the work itself was contemptible, yet when done and seen was worthy of admiration. The overseer and master of the work, was one Pheax, an excellent artificer, from whom these conduits were called Pheaces. The Agrigentines likewise formed a tank for fish, at great cost and expense, seven furlongs in compass, and twenty cubits deep. This by neglect of succeeding ages, filled up with mud, and at last through length of time turned wholly into dry ground; but the soil being very fat and rich, it was planted, and yielded the city a large revenue.

Themistocles has the merit of projecting and carrying into effect the construction of a haven at the Pyræus, by which the naval power of Athens was greatly increased. The account of his negotiations with the assembly of the people is of much interest in an historical sense, but not immediately relating to the end we have in view, we are compelled to omit it.

In the 21st chapter is mentioned the diversion of the Nile during the war between the Persians and Egyptians.

Blocking up of the Euripus.—In his 13th book our historian describes the measures taken by the inhabitants of Eubœa on their revolt from the Athenians. This island being separated from the continent only by the narrow strait of the Euripus, they solicited the Beotians to assist them in stopping it up, in order that they might receive assistance against any attacks from the Athenians who were masters of the sea. To this the Beotians agreed, and all the cities set upon the work, and every one strove with diligence to perfect it, all the citizens, foreigners and strangers being set to work. The mole began at Chalcis in Eubœa on one side, and at Aulis in Beotia on the other, that being the narrowest part. In these straits the sea was very boisterous and rough, but after this work much more unquiet and raging, the passage being made so very straight and narrow, that only one ship could pass through. There were forts built on both sides upon the extremities of the moles, and wooden bridges made over the currents for communication.

IMPORTANT INVENTION IN MACHINERY.

It has been often said that the Steam engine now in use will in time be displaced by some invention less in bulk, cost and risk of explosion, and at the same time equally powerful for all the purposes to which the steam engine is now applied. Whether the invention of the engines described in the following extract is a first step towards the looked-for improvement, the scientific reader can judge.—*National Intelligencer.*

[From the London Times.]

Our attention has been called, by an article in one of the provincial newspapers, to a very important mechanical invention, for

which a patent has recently been granted to two Scotch gentlemen, and which promises to effect a greater and more beneficial change in the working of machinery than has taken place since the brilliant discoveries of Watt. The two great drawbacks of the steam engine (besides the large space it occupies) have been the *bulk*, and the consequent *expense* of the fuel which it requires, the latter preventing its application to many purposes for which it would otherwise have been a most effective agent, and the former impeding its locomotive energy, and confining it, particularly as regards navigation, within comparative narrow limits. Any reduction in either of these respects is thereby obviously so much *clear gain*. The invention to which we allude promises to effect a prodigious saving in *both*, by diminishing the expenditure of fuel to somewhat less than *one-fifth* of what is now required for an equal degree of power. It has already, we are informed, been put to the test by the construction of an engine of about twenty horse power, which has for some time been driving all the machinery of an extensive foundry, with no larger consumption than we have just mentioned, and with every prospect of a considerably greater reduction being effected by some slight changes in the details. The motive power used is the common atmospheric air; and another great advantage of the new engine arises from a saving of space equal to what is usually occupied by the furnace and boilers of a steam engine.

If these things be so, it is impossible to calculate the results to which so important a discovery must lead. But we hasten to present our readers with the following description of the engine, which we have abridged from the newspaper already referred to:

Description.—The air-engines now working at the Dundee foundry, for which a patent was lately taken out, is the joint invention of the Rev. Dr. Stirling, of Galston, and of his brother, Mr. Stirling, engineer, Dundee.

The principle of the invention consists in alternately heating and cooling two bodies of air confined in two separate vessels, which are so arranged that by the strokes of two plungers, worked by the engine, the whole of the air contained in one of the vessels is sent to the lower end immediately over the furnace, and is consequently made quite hot, while the whole of the air contained in the other vessel is at the same time transmitted to the upper end, which is cut off from any communication with the furnace, and is therefore comparatively cold.

The expansion caused by the heat renders the air in the one vessel alternately much more elastic than that of the other; and the two ends of the working cylinder, which is fitted with a piston similar to that of a steam engine, being respectively connected with the two air vessels, a preponderating pressure is produced, by turns, on each side of the piston, which is thereby pushed to the opposite end of the cylinder; and so, by the alternate action of the plungers in the two air vessels, it continues a reciprocating motion, and is applied to turn a crank in the same way that a steam engine does.

It has been satisfactorily shown that this engine may be worked with very great economy of fuel as compared with a steam engine.

The principal means of producing the saving is this—that of the heat which is communicated to the air from the furnaces, only a very small portion is entirely thrown away when it comes again to be cooled; for, by making the air, in its way from the hot to the cold end of the air vessel, to pass through a chamber divided into a number of small apertures or passages, the great extent of surface with which it is thereby brought in contact, extracts from it in the first place, but only temporarily, the greater part of the heat, and afterwards restores it to the air on its passage back again from the cold to the hot end of the vessel. The process of cooling is finally completed by making the air pass through between a number of tubes in which there is a current of cold water, and thus far the heat cannot be made available again, but the portion which is abstracted in this way is very small.

As a sufficient expansive power could not be obtained in so small a space without great alternations of temperature from using air of the common density of the atmosphere, the air used is pretty highly compressed, and a much greater power is thereby obtained upon a given area of the piston.

A small air-pump, worked by the engine, is therefore necessary to keep up the air to the requisite density; but very little power is expended on this; all that is required of the pump, after the engine has been once charged, being to supply any loss of air that may arise from leakage, which is found to be very trifling.

The machine has been working occasionally for above six months, and it has been proved to be capable of performing advantageously the amount of work which the inventors had anticipated from their calculations and previous experiments. It has now for upwards of a month been driving all the machinery at the extensive engineering works of the Dundee foundry, which a steam engine of approved construction had hitherto been employed to do; and it has been ascertained that the expenditure of fuel is, *ceteris paribus*, less than one-fifth part of what was required for the steam-engine; but, as considerable improvements are contemplated in some of the details, it is confidently expected that a much greater saving will eventually be effected.

The whole machine, including the furnaces and heating apparatus, stands in about the same space that a steam engine of equal power would occupy without furnaces and boiler. Taking into account the saving of space, along with the vast economy of fuel, this invention must necessarily be of immense importance for all ordinary purposes requiring motive power. As an instance, it would reduce the expense of the power employed in driving machinery in Dundee alone, by at least £25,000 or £30,000 a year. But viewed in reference to the purposes of navigation, it must lead to results still more extraordinary, and will render a voyage to India round the Cape by machinery a matter perfectly easy of accomplishment.

THE EVILS OF WOOD PAVING.
The following from the London Herald of 23d October, will be read with interest by all who are engaged in preparing wooden pavements in the United States:

MR. EDITOR: There is one awful drawback which accompanies wood paving, and if it be not obviated before the consequences are impressed upon the public mind, it will be likely to create so strong a prejudice against its universal adoption, that the blocks already down may have to be taken up again through legislative interference, and the use of wood prohibited.

Wood runs so rapidly to decay when subjected to humidity, that the best seasoned timber exposed to damp soon becomes decomposed and putrescent. The albumen contained in it, like similar matter in animal substances, is a susceptible germ of rottenness, which straits into existence the moment the combined energies of wet and warmth reach it, and then its desolating influence spreads with a rapidity that nothing can reach or control.

Wood paving is not only acted upon by these two fertile sources of decay, but its fibres soon become impregnated with pestilential carburetted hydrogen, which exudes through the gas pipes, saturates the surrounding earth, and being that very substance which escapes from animal and vegetable bodies when in a highly putrefactive state, it will have a tendency to assist rapidly in the decomposition of the blocks.

Long before half the streets of this metropolis are covered with such a pavement, the "malaria" that will arise from so extensive a mass of vegetable corruption will sweep off its inhabitants more numerous and with more unerring certainty than the "plague of London," because every individual will be incessantly breathing the deadly venom floating in the poisoned atmosphere.

This is no imaginary theory. I have seen its deleterious and disastrous effects in those parts, where, from vegetable decomposition, human victims, thus infected, die like rotten sheep.

These lamentable results can, however, be prevented by the blocks undergoing a previous preparation in a solution of the "bichloride of mercury," which stops fermentation, renders vegetable albumen insoluble, hard, anti-putrescent, incorruptible, and therefore indestructible through the agency of decay.

Now this fact being no longer doubtful, parish boards will be neglecting a very sacred public duty if they do not in future stipulate that all blocks shall be so prepared, not only to preserve the general health, but from motives of economy, as it is admitted that it increases their durability fourfold.

Yours respectfully.

W. A. KENTISH.

London, October 20, 1841.

